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GEOPHYSICS IN HUNGARY

A Magyar Tudomany Tiz Eve, 1945-1955
/Ten Years of Science in Hungary, 1945-1955/, 1955, Budapest,
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The field of geophysics is properly the science of the physics of the Earth, and thus in a broader sense includes the fields of seismology, investigation of terrestrial magnetism and electricity, meteorology, hydrology, oceanography, and vulcanography. In Hungary the fields of hydrology and meteorology are represented by separate main committees of the Academy of Science, but on the other hand gravitational investigations, which in many countries are classed under geodesy, are listed under the field of geophysics. This is general or pure geophysics, under which the field of applied geophysics, serving industrial aims, has undergone very rapid development during the past decade, including especially geophysical research on industrial minerals.

On a domestic scale general geophysics includes scientific research in the fields of gravity, terrestrial magnetism, and seismology.

Gravitational investigations. Hungarian science has a rich heritage in the field of the mass attraction force of the Earth, including the world-wide acknowledgement achieved in this field in the 1880's by the Hungarian scientist Lorand Eotvos. Although since 1915 most of the measurements which have been made utilizing the Eotvos balance were performed by the Eotvos Lorand Geophysical Institute and by private enterprises for the purpose of the discovery of hydrocarbon deposits, some of these measurements also were subjected to scientific procedures. Since liberation increasing use has been made of modern gravimeters in making gravimetric measurements, so that Hungary has become one of the most extensively gravimetrically measured countries of the Earth. Several valuable studies have been devoted during the past 10 years to the precise correction of gravitational values. The book Gravitacios meresek es izosztazia /Gravity Measurements and Isostasis/ by Laszlo Facsinay and published by the Academy of Science discusses gravitational measurements and their corrections and reductions, including isostatic reduction. This book also lists Hungary's local isostatic anomalies.

The gravitational investigations are aided by the republication of the relatively inaccessible works of Eotvos by the academy publishing house under the title of Roland Eotvos Gesammelte Arbeiten /Collected Works of Roland Eotvos/. This book was published on the thirtieth anniversary of the death of Eotvos, and in 1948 on the one hundredth anniversary of his birth, the international periodical entitled Geofizica pura e applicata /Pure and Applied Geophysics/ published an Eotvos memorial issue, most of the scientific tracts of which were by Hungarian authors.

It is noted with regret however that the old gravitational measurements are related to several different reference points, which confuses the unified depiction and evaluation of the gravitational values within Hungary. Partly because of the latter, and partly for the purpose of developing calculations related to the shape of the Earth and other scientific investigations, in 1951 the Eotvos Lorand Institute of Geophysics completed the first-order national gravitational network survey and at the present writing has nearly completed the second-order national gravitational network survey. The methodological problems of measurement used in both surveys were discussed and debated by the main committee of geodesy and geophysics of the academy. In the near future the Hungarian system should be related to one or 2

international reference points, thus joining the Hungarian network to a system including all gravitational measurements which ever have been made. Better methods have been developed for coordination of measurements utilizing the Eotvos pendulum and gravimeter.

Investigation of the effects of the sun and moon on gravitational values also has begun in Hungary. These investigations however still are in an experimental stage. The geophysical observatory at Tihany, which was completed in 1954, will be suitable for the systematic investigation of these effects.

Despite the great area required by the gravimeter the Eotvos pendulum is a very important instrument, especially in the field of upper strata geodesy. Therefore the modernization of the Eotvos balance is an important task for the future, aside from the performance of such work out of a sense of duty to the memory of Lorand Eotvos. In addition to several theoretical projects along this line, a prototype of a new Eotvos pendulum has been completed in the shop of the Institute of Geophysics.

Investigations of terrestrial magnetism. After liberation at the suggestion of the Academy of Science the Eotvos Lorand Institute of Geophysics took over the task of performing the national terrestrial magnetism measurements which previously had been done by the Institute of Meteorology and Terrestrial Magnetism. The former institute previously had been engaged in performing magnetic measurements for the state for the purpose of prospecting for industrial minerals. The majority of the 1949-1950 national magnetic measurements were performed by the Institute of Geophysics, and the regularities of the regional variations in terrestrial magnetism elements related to the period marked by the beginning of 1950 also were determined at this institute. Studies also were conducted on increasing the accuracy of the Liznar method used in the latter computations.

Prior to 1918 the chronological variations of terrestrial magnetism elements were continuously observed at the Ogyalla observatory. In 1948 a temporary registering station was opened at Budakezi, and in 1954 this station was moved to the very modernly appointed geophysical observatory at Tihany.

The results of the 1949-1950 national magnetic measurements and the 1949-1950 measurements and computations of the Budakeszi registering station appear in the book A foldmagnessegi ero valtozasai Magyarorszagon /Variations in Terrestrial Magnetism in Hungary/ by Gyorgy Barta which was published by the Academy of Science and has appeared in many languages. The data gathered in more recent years gradually will be published, also.

Investigations were conducted in Hungary apropos of supplementing the incomplete data of individual observatories through the conversion of equivalent data of other stations. On the basis of long series of data obtained in this manner it was determined that a cycle of approximately 44 years is superimposed on the 100-year period. This is observable in the series data of many foreign observatories also.

Earthquake investigations. Investigations relative to earthquakes originally were performed by the Institute of Meteorology and Terrestrial Magnetism. In 1905 a part of this institute was formed into the National Earthquake Investigation Institute, which continued after liberation as the earthquake investigation department of the Eotvos Lorand Institute of Geophysics. Unfortunately the central building of the institute at Budapest, with all its important equipment was destroyed during the hostilities. Only part of this equipment has been replaced so far, and at present only the horizontal components of distant disturbances can be recorded.

Under the department are earthquake investigation stations, located at Kalocsa, Kecskemet, and Szeged, which send their data to Budapest. The Budapest department submits the data in the form of daily, monthly, and yearly reports to the international service.

The annual microseismic reports of the Earthquake Investigation Institute and department are published in catalogue form. The results of a study of the Budapest daily curve also have been published, and the Academy of Science has published a work by Antal Rethly entitled A Karpatmedencek foldrengesei /Earthquakes of the Carpathian Basing/, which reviews all available earthquake data recorded between the years 455 and 1819, and which fill gaps in the knowledge of this field.

Geophysical research began to gain impetus when the great practical and economical importance of this field to applications within the oil industry were recognized. This practical relationship had a beneficial effect on science, also. The refined methods and perfected instruments assisted in gaining knowledge of the Earth as a whole as well as the practical task of investigation of the structure of a small area and shallow depth of the Earth's crust. For example, the Worden gravimeter, which is one of the most ingenious instruments of contemporary geophysics, is ideal for geophysical investigations in the polar ice fields, is very convenient for use in the depths of mines, and its development signified a great advance in the field of the determination of the shape of the Earth.

Hungary is in the happy position of being able to call herself the cradle of geophysics. Not only because the ingenious invention of Lorand Eotvos, the Eotvos pendulum, is a milestone in the advance of science, but also because of the original discovery by Hugo Bockh of the correlation between oil-bearing geological structures and the gravitational irregularities which may be detected through the use of the Eotvos pendulum.

During the period following World War I scientists from all over the world came to Hungary to study. During the early days of geophysics nearly all the great scientific names visited Hungary to learn the theory and practical use of the Eotvos pendulum. After having had such a great advantage, it could have been expected that Hungary would continue to play a leading role in the field of geophysics. However the circumstance that the Hungarian Institute of Geophysics was not built in 1926 because of the debate surrounding the filling in of the Lagymanyos River, sealed the fate of geophysics in Hungary for 2 decades. Although some geophysical research was conducted, this research was primarily devoted to the foreign capital interests which sponsored this work, and it served the national interest only secondarily.

A considerable change occurred in 1948. The development of geophysical research began at this time, following recognition of the needs of the public economy. This development consisted of the introduction of new geophysical research methods, as well as expansion of the field of research. The results of the research which at that time was proceeding at a great rate included the introduction of the seismic, geoelectric, geothermal, geochemical, and radiological methods and deeper pursuit of the previously begun gravitational and terrestrial magnetic research.

The national gravitational and magnetic network, which is a part of the international network and satisfies contemporary demands, combines earlier measurements into a unified system and thus in many instances offers new possibilities for regional evaluation of gravitational and magnetic data.

The perfection of instruments and methods opened new possibilities in the field of the scientific development of gravity data. The results of the latter include, among others, the discovery of productive oil fields.

The geophysical observatory, the planning of which required long years of thorough and circumspect scientific planning, now has been completed. On 15 November 1954 the Tihany magnetic observatory was officially occupied by its operating agency. From the point of view of general geophysics this observatory is a link in the world-wide network of observatories, and from the point of view of domestic research it constitutes the main base for reduction of primary measurement data.

The gravity and magnetism research was not devoted solely to the study of large geological structures for the oil industry, but included also scientific research aimed at the discovery of mineral deposits which are important to the public economy. The Eotvos Lorand Institute of Geophysics and the Sopron Labor Cooperative have obtained important results in gravimetric measurements conducted in connection with coal and bauxite research.

The bases of modern seismic investigations in Hungary were laid with the work begun by researchers of the Eotvos Lorand Institute of Geophysics in 1948. On the basis of their experience in the field these researchers designed seismic apparatus which completely satisfies the demands of modern geophysics. This seismic instrument compares favorably with foreign types, and the Geophysical Measuring Instrument Plant now manufactures these seismic reflection-type measuring instruments for export as well as for domestic use.

Fruitful structural investigations were performed in the area of Mihalyi and Nagylengyel. It is hoped that this method will yield results in areas which have yielded unevaluable seismic data. As a scientific byproduct of the telluric investigations a basic interrelationship was found to exist between telluric currents and the rapid fluctuations in the magnetic field of the Earth. This discovery opened the possibility of magnetotelluric research.

The chair of geophysics of the Eotvos Lorand University (Chair Head Laszlo Egyed -- (Ed.)) is conducting geoelectric and magnetic investigations and is conducting work on the determination of the physical properties of domestic rock strata. Excellent results have been obtained in experiments performed at this academic chair on induced potential. In addition to experiments, intensive work is being done at this chair on the physics of the Earth. Some basic determinations have been made at this chair concerning the origin of oceanic trenches, and important contributions have been made on the problem of the shape of the Earth.

Electrical research was begun at the Eotvos Lorand Institute of Geophysics in 1951. The results of this research greatly aided the ore mining at Recsk. Basic research is being done at this institute in the field of deep-drilling geoelectrics.

Numerous results have been achieved in the field of geothermic methods. A new geochemical method has been developed at the Institute of Geophysics. Until very recently radiological research was having difficulty in obtaining instruments. Although some important research results have been achieved, more development is necessary in this field.

This survey has presented only an outline of the results which have been achieved. Comparison of the former situation with the present shows that the Institute of Geophysics, which at one time was housed in the same building with the Institute of Experimental Physics, now is a great institution with approximately 400 personnel, even though its planned permanent building still has not been completed. Scientific research is being conducted at the chairs of geophysics of the University of Budapest and the Sopron Technical University. The geophysicists and geophysical engineers of the future are being trained in these institutions of higher education.

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The Society of Hungarian Geophysicists was founded this year. Starting with this year research under the auspices of the Academy of Science will be controlled by an independent Main Committee of Geophysics.

Looking back on the past it may be said that the Hungarian scientists of that time also had discharged their duty to the nation, although their achievements were limited by the limiting circumstances which prevailed at the time. At the present however the tree of science is flourishing in Hungary, and the future may be viewed with the brightest hope.

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